INTERNAL REPORT 115

DECOMPOSITION PROCESSES AND BIOMASS REDUCTION OF DOUGLAS-FIR SAPWOOD WITHIN A DOUGLAS FIR FOREST ECOSYSTEM

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INTRODUCTION

Wood comprises 70 percent of the biomass of the Douglas-fir ecosystem.[2] The reduction of biomass and release of carbon into the carbon cycle are important aspects of decomposition processes within a forest ecosystem.

Little is known about the biochemistry of those stages of decomposition which occur between primary degradation of wood and the ultimate conversion of degradation products into carbon dioxide and water.

The objectives of this study were twofold: (1) to study the conversion of carbon compounds during primary decomposition, and (2) to investigate the rate of reduction of biomass of Douglas-fir wood by fungal action.

Materials and Methods

To study the pathways of primary decomposition and maximum rates of decomposition of Douglas-fir sapwood, the following procedures were used:

Blocks of Doublas-fir sapwood measuring 2 cm. x 2 cm. x 1 cm. were exposed to *Poria weirii* (Murr.) using a modification of the standard soil block technique.[1] *Poria weirii* was selected as the test fungus because it is a common pathogen and wood destroying organism occurring in the Douglas-fir ecosystem.

At 90 day intervals for a period of one year blocks were removed from the soil block test, dried at 65°C for 24 hours and a specific gravity determination made in accordance with TAPPI method T18M-53(7).

To determine the effects of fungal induced decomposition of wood on extractives the samples were prepared for solubility evaluation by TAPPI method T11M-59(6).

The pathways of decomposition and reduction of biomass under field conditions were investigated by utilizing a stake decomposition test installed at Cedar River watershed in June 1972. Similar studies have since been installed at the Finley Lake and Andrews Forest sites.

The test materials evaluated were Douglas-fir sapwood stakes measuring 10 cm. x 1.5 cm. x 7 cm. After weighing and labeling, the stakes were exposed to one of the following conditions of decomposition: (1) 10 cm. deep in the mineral soil, (2) under the litter layer, and (3) on the surface of the forest floor litter.

At 30 day intervals seven replicate samples were taken from each treatment for evaluation. After determining specific gravity, all of the stakes from a single treatment were prepared for solubility evaluation by TAPPI method T11M-59(6). Three, two gram samples (moisture free equivalents) were extracted successively with cold water for 24 hours, hot water for six hours (T1M-59(3), alcohol/benzene (T6M-59(5) for six hours and one per cent sodium hydroxide (T4M-59(4).

Results and Discussion

Since wood comprises the major biomass component of the Douglas-fir ecosystem, its decomposition plays an important role in reducing biomass within the ecosystem.

Under ideal conditions such as the soil block test, a common white rot inducing fungus (P. weirii) is capable of reducing the biomass of Douglas-fir sapwood by 60 per cent in a one year period (Fig. 1). Applying this decomposition rate to Dice's[2] estimate of 10.1 metric tons per hectare per year of production represents a reduction of 6.1 metric tons per hectare per year.

To relate biomass reduction to amount of carbon cycled, it is necessary to note that wood is 49 to 50 per cent carbon.[8] This amounts to approximately 3 metric tons per hectare per year of carbon that is oxidized and cycled within the ecosystem.

Since these data were obtained under ideal conditions, they would appear to be somewhat high. However, this estimate reflects the ability of a wood destroying fungus to substantially reduce wood biomass.

Data in figures II through V indicate that under natural conditions dissolution of wood components by decay fungi is slower and proceeds in a stepwise manner.

During the first month of exposure, short chain polysaccharides and other materials soluble in cold water are apparently leached or utilized by non-decay microorganisms (Figs. II and V). However, as decay progresses, the wood constituents are depolymerized and accumulate until they are either leached or converted to volatile respiratory products by soil microorganisms. This conslusion is supported by the data in Figures II, III and V which show accumulations of soluble materials and then rapid decreases which are followed by an upward trend.

These data on stake decomposition under natural conditions were the results of preliminary studies and, therefore, should not be considered conclusive. Further research is being conducted to test these findings.

Literature Cited

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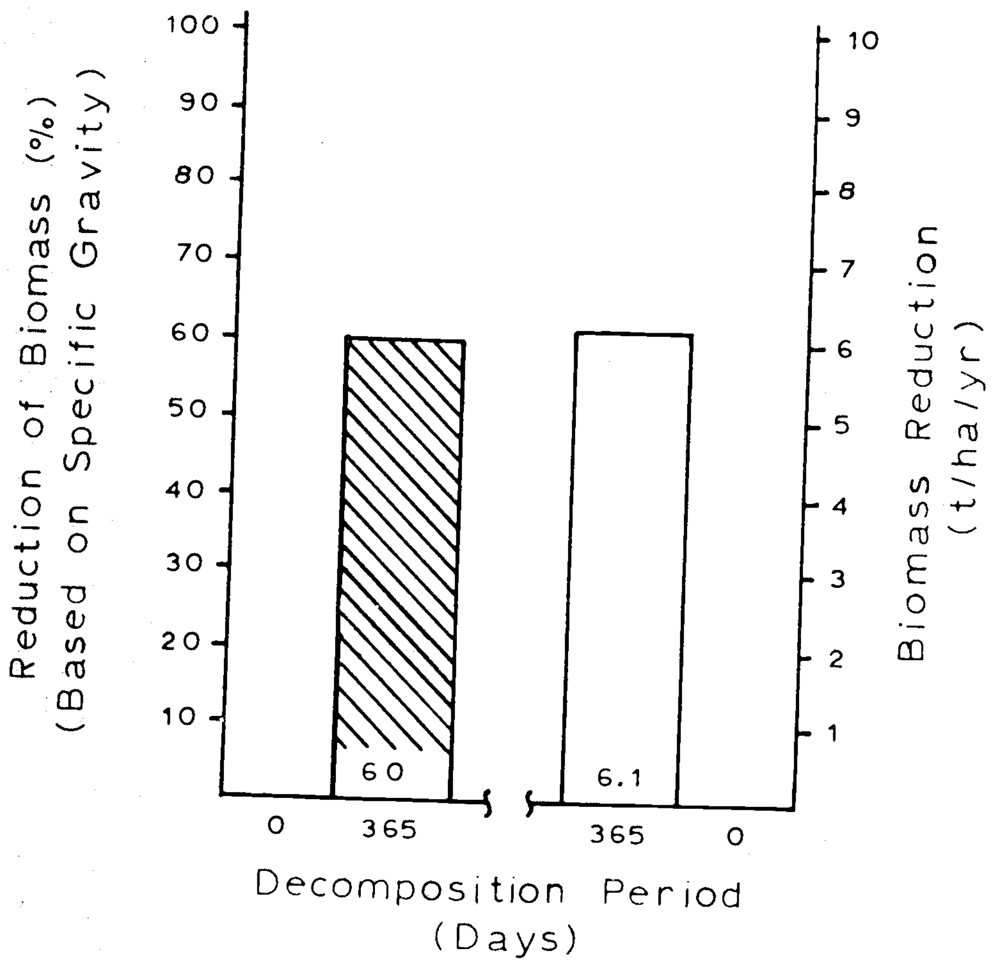

Figure 1. Maximum rates of reduction of biomass of Douglas-fir sapwood as determined from soil block tests.

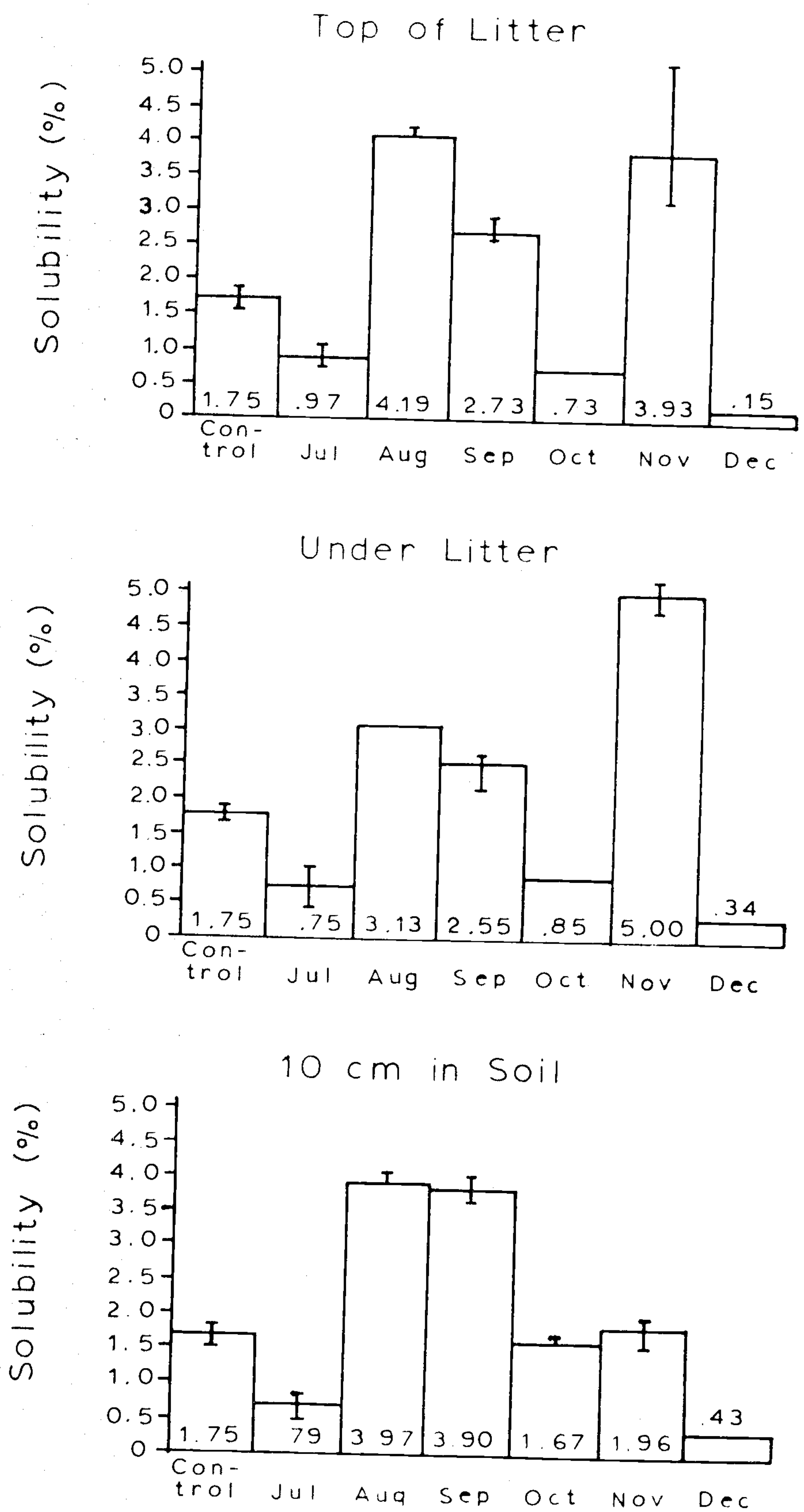

Figure II. Cold water solubility of Douglas-fir sapwood stakes after exposure to field decay conditions.

| = Range of values represented by mean.

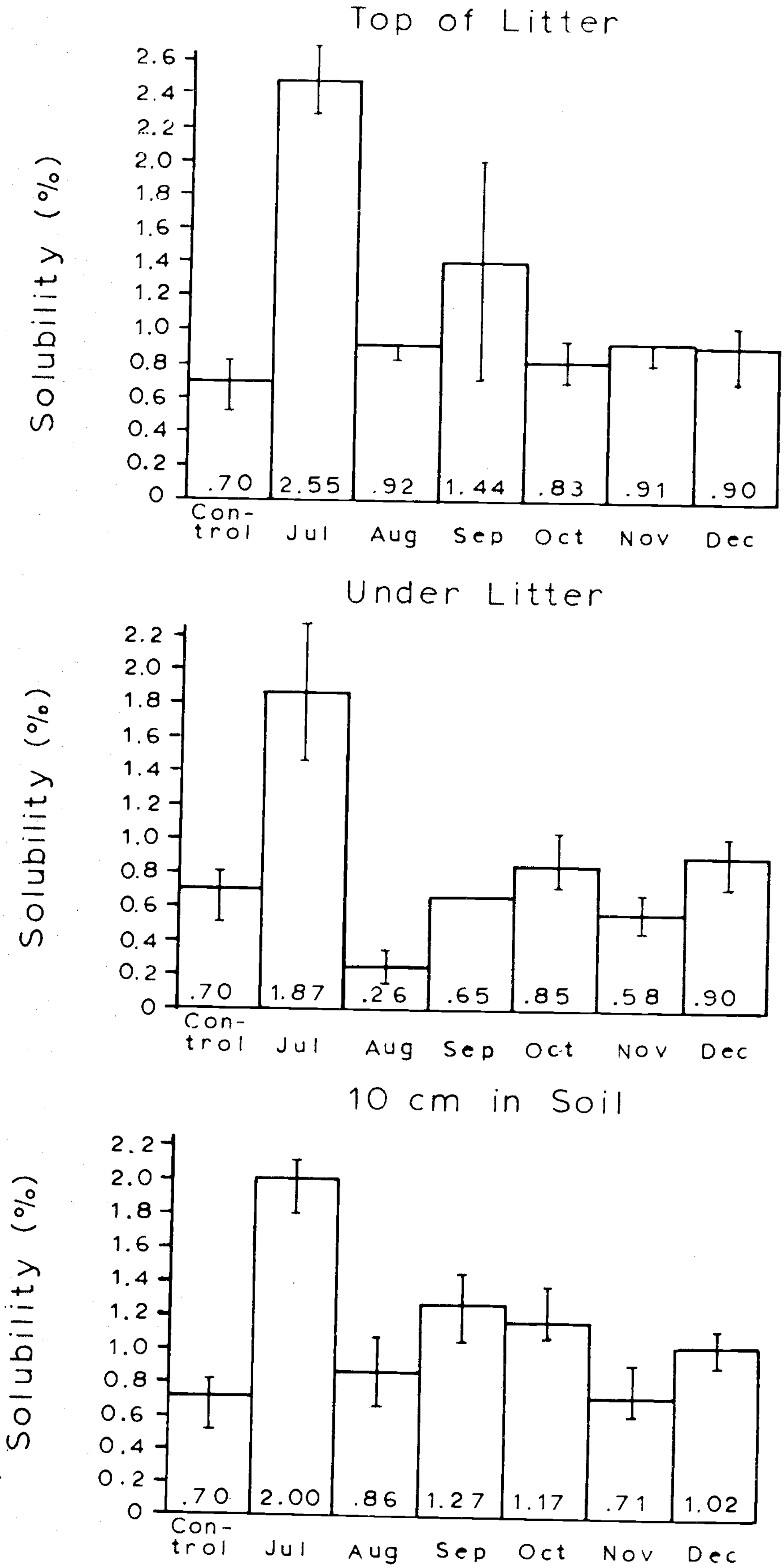

Figure III. Hot water solubility of Douglas-fir sapwood stakes after exposure to field decay conditions.

| = Range of values represented by mean.

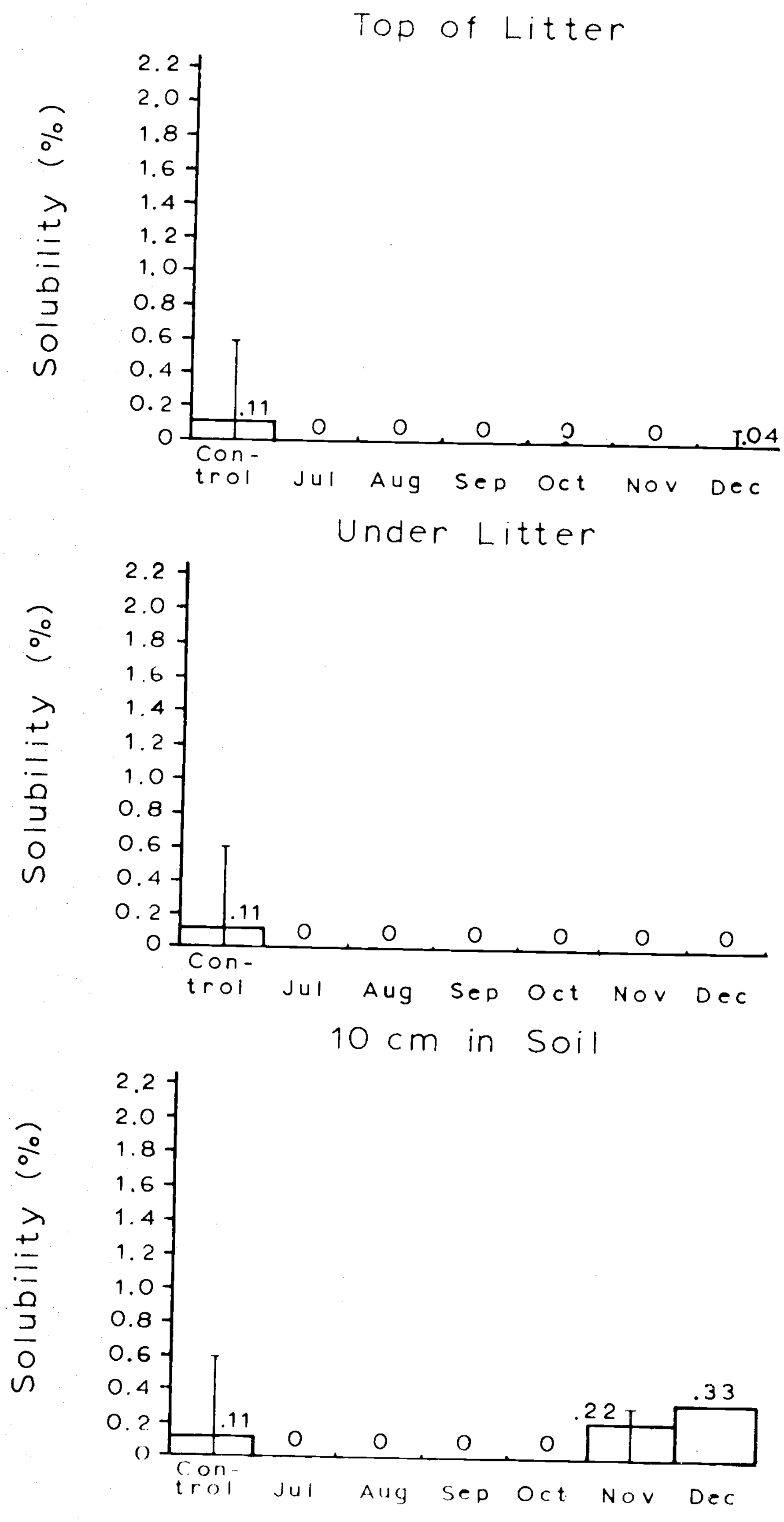

Figure IV. Alcohol/benzene solubility of Douglas-fir sapwood stakes after exposure to field decay conditions.

| = Range of values represented by mean.

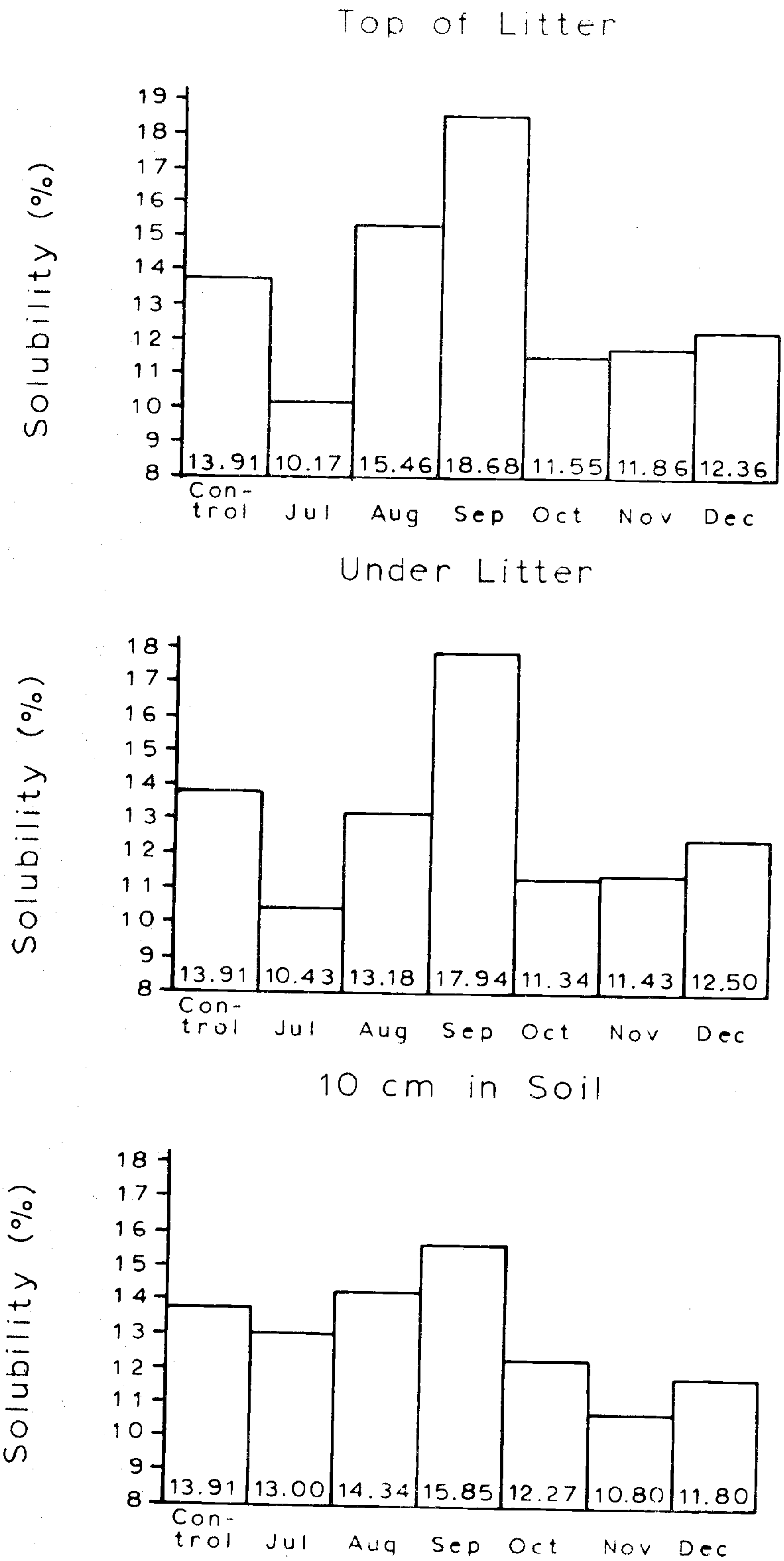

Figure V. NaOH solubility of Douglas-fir sapwood stakes after exposure to field decay conditions.